Compliance Test Methodology for EDC enabled MMF Links

Venu Balasubramonian, Abhijit Shanbhag,
Abhijit Phanse, *Scintera Networks*

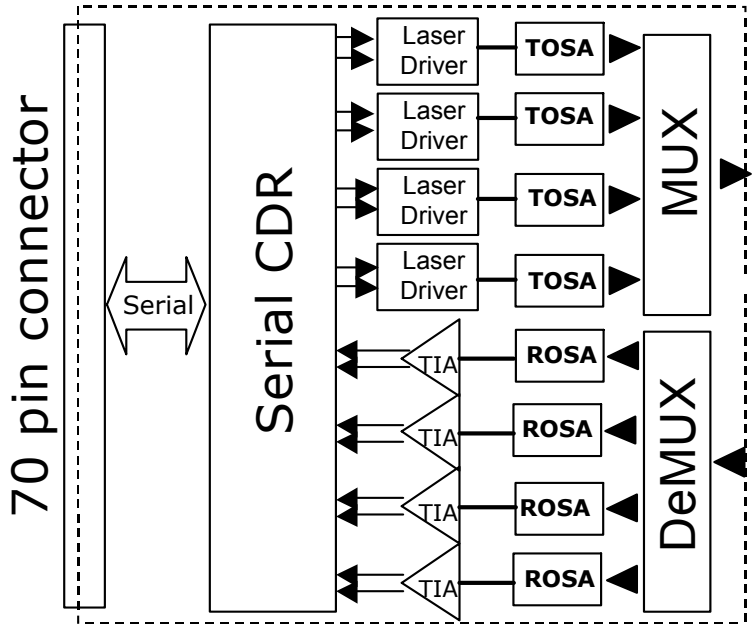
Badri Gomatam and Kevin Witt, *Vitesse*

Scintera Networks Inc.
4340 Stevens Creek Blvd Ste 260, San Jose, CA 95129

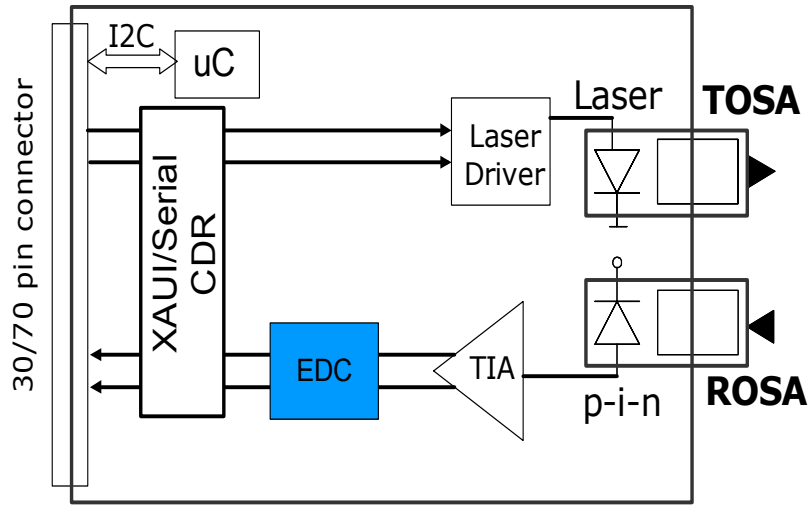
Agenda

- Link Compliance testing for EDC-enabled link
  - The EDC Solution
  - The Test Methodology
  - Normative Tests
  - Informative Tests
  - Conclusions

The EDC Solution



LX4 (CWDM)



EDC Solution

Lower cost, Lower Power (Moore's Law Scaling)
Form factor agnostic: XENPAK, X2, XFP

The EDC Solution

- Serial Receiver-only Based Equalization
- Specify a new PMD
- No changes to PCS and PMA specs
- Blind Automatic Adaptation. No requirements for training sequences.
- Reduces component count => Lower cost
- Relax the transmit specifications. Reduce costs.
  - Allow for FP, and VCSEL based solutions

The EDC Solution

- Need to specify the a set of representative worse case channels for MMF
- Need to allocate ~4-6dB power budget for EDC. Can be extracted out of the LR budget.
- Need to specify receiver linearity requirements to provide a usable dynamic range.
- Need to specify/budget for Responsivity variations versus spatial offset for receiver.

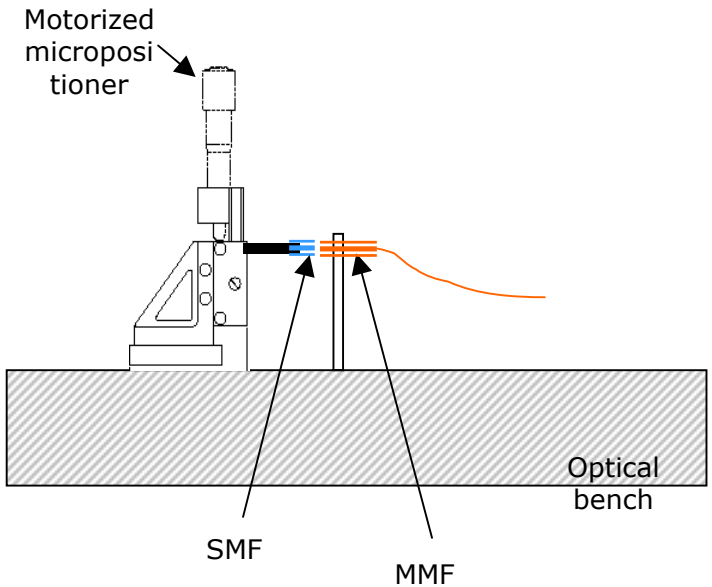
Test Methodology - Objectives

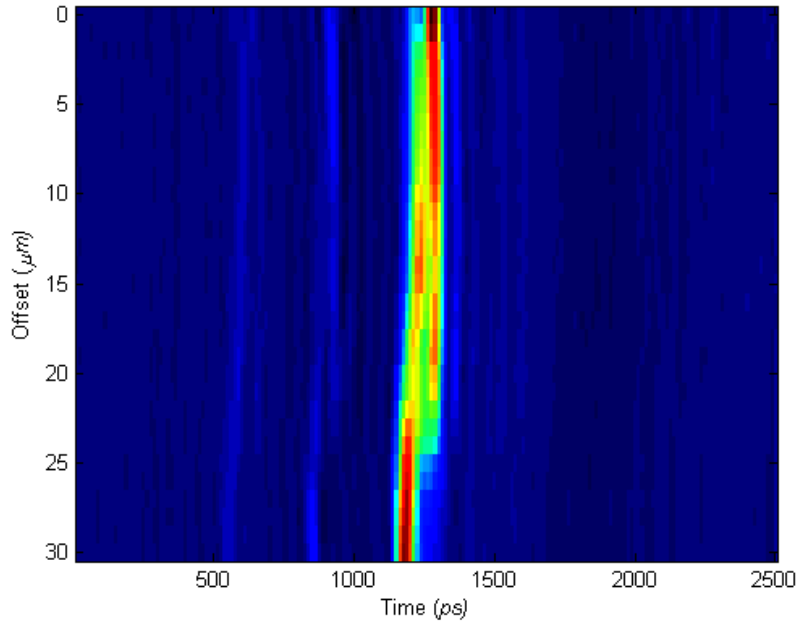
- Enable low-cost and quick time-to-market modules across broad vendor base.
- Sufficiently stressed link to cover large percentage of installed fiber base.
  - Use reasonably conservative “worst-case” channel models
  - Should cover time varying channel effects
- Small number of tests (preferably 1); easy to use, repeatable and deterministic.
- Supports scaling for high volume at low cost.

Test Methodology

- Representative worse case MMF channels
  - Characterize the channels

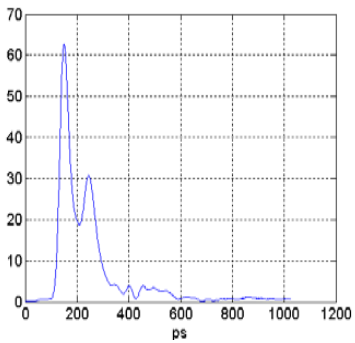
Controlled offset launch





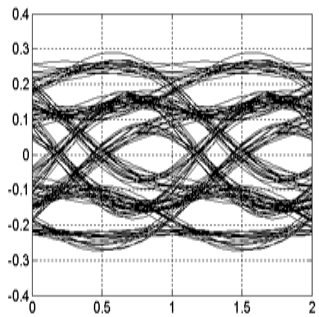
Test Methodology

- Reproduce Representative worse case MMF channels
  - Emulate these channels for a reproducible test methodology which is available to everybody
  - FIR Filter with sufficient tap resolution and sufficient number of taps to cover the representative worst case
  - Tap coefficients can be varied to model time variance.

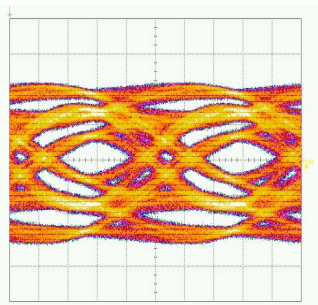


Fiber Impulse Response (N04A1002S3p.dat)

Fiber Impulse Response (LG010401L4f.dat)



Simulated eye of waveform

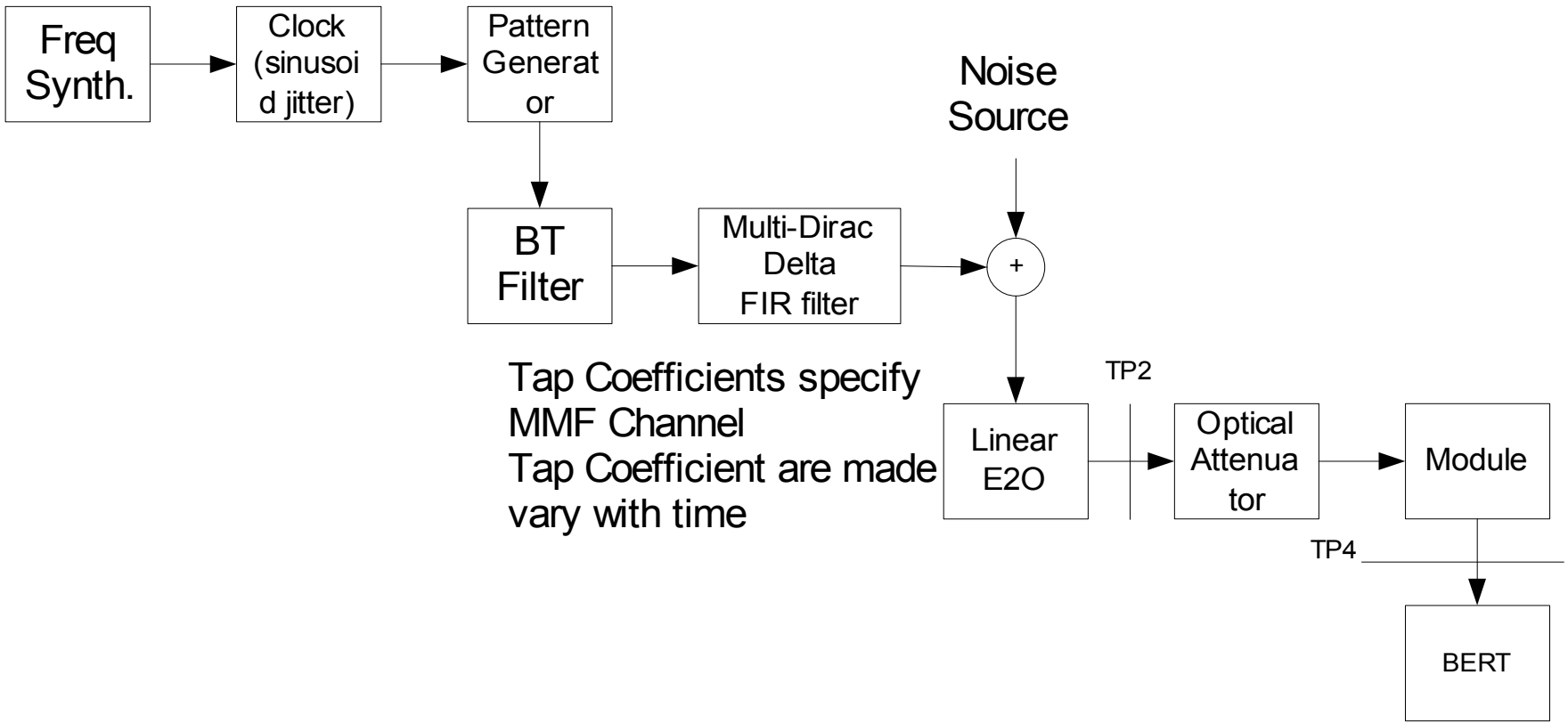


Emulated waveform eye using LPF and FIR

Tests

- Normative:
  - Receiver Compliance Test
  - Transmit Compliance Test
- Informative:
  - ROSA Compliance Test
  - EDC/PHY Compliance Test

Normative: Receiver Compliance Test

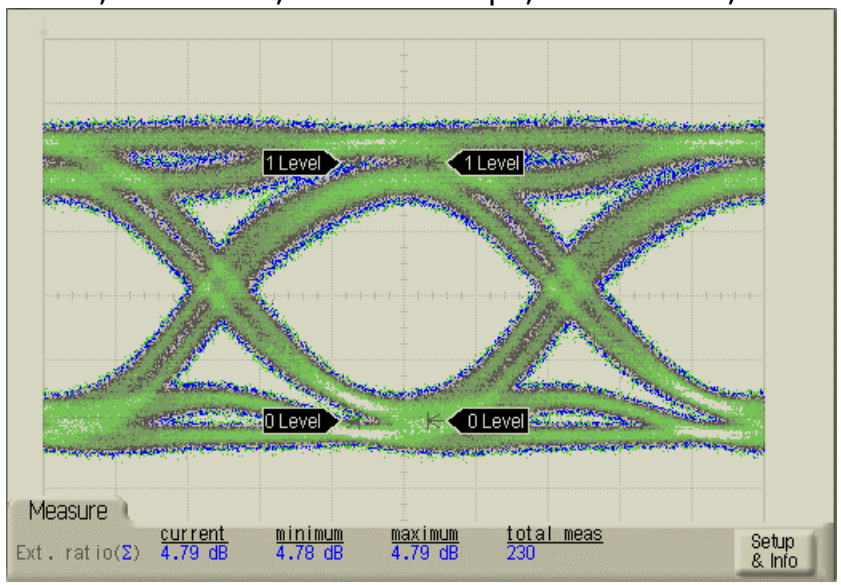


- Test for compliant performance at TP4 for specified BER (1e-12)
- Jitter compliance

Normative: Transmit Compliance Test

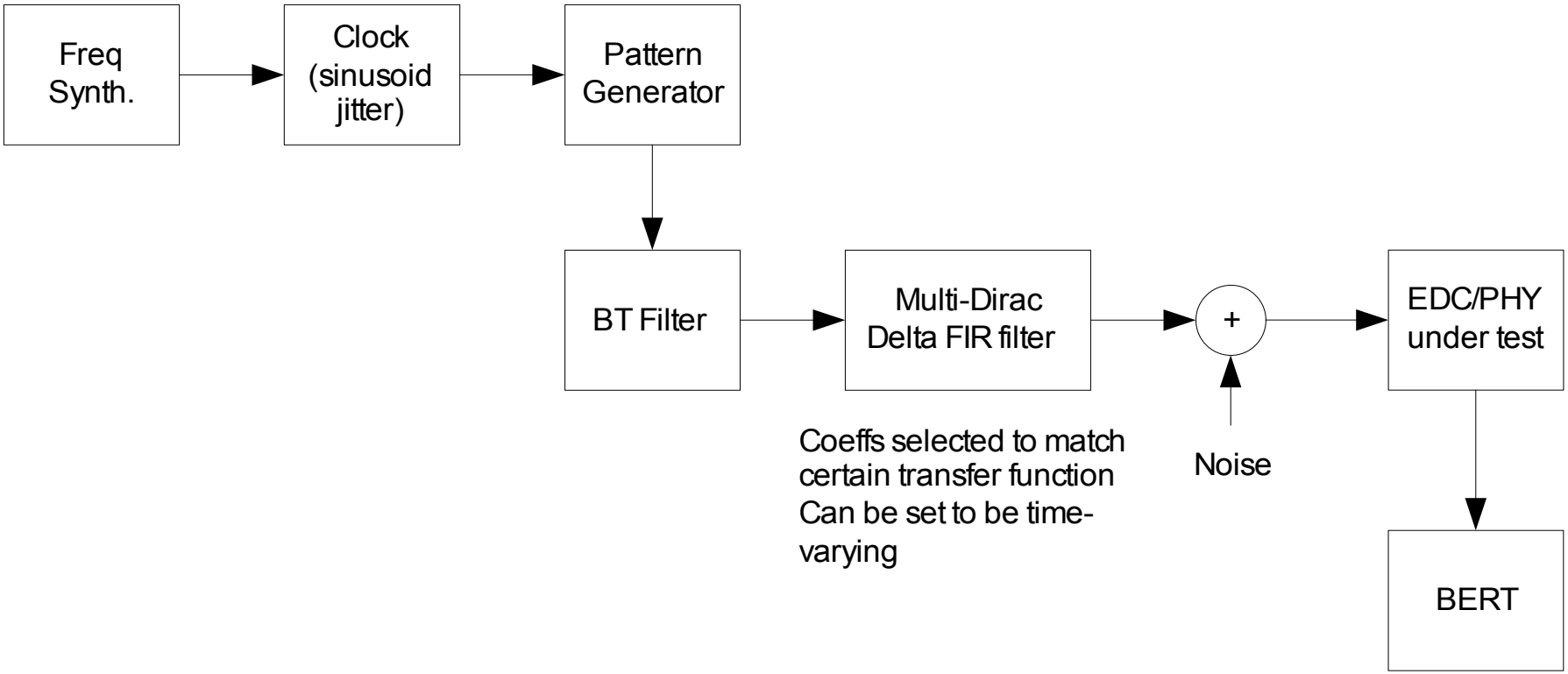
- Average optical power, OMA, rise/fall time measured at TP2 at IEEE offset launch

DFB, unfiltered, 10.3125 Gbps, PRBS 2^{23}-1, NRZ



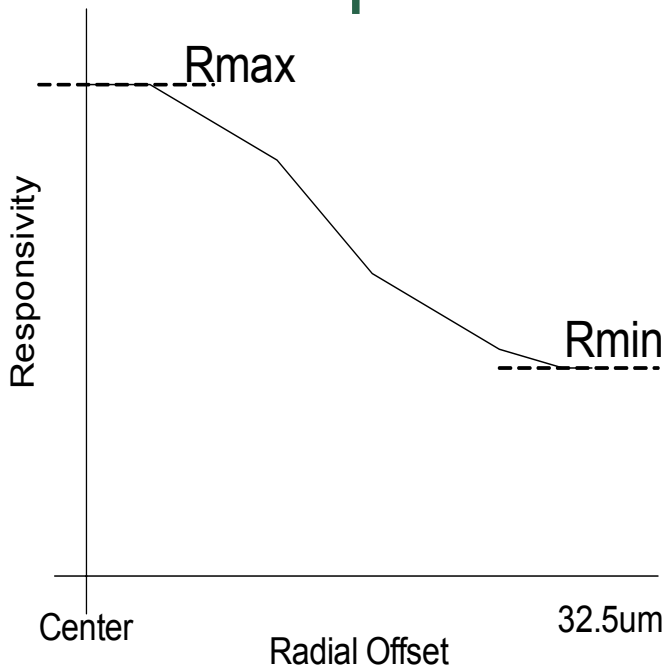
- **Allow for sufficient relaxing of TX specs to allow for cheaper TOSA, low-cost packaging (TO-CAN), lower cost 10GE modules**

Informative: EDC/PHY Compliance Test



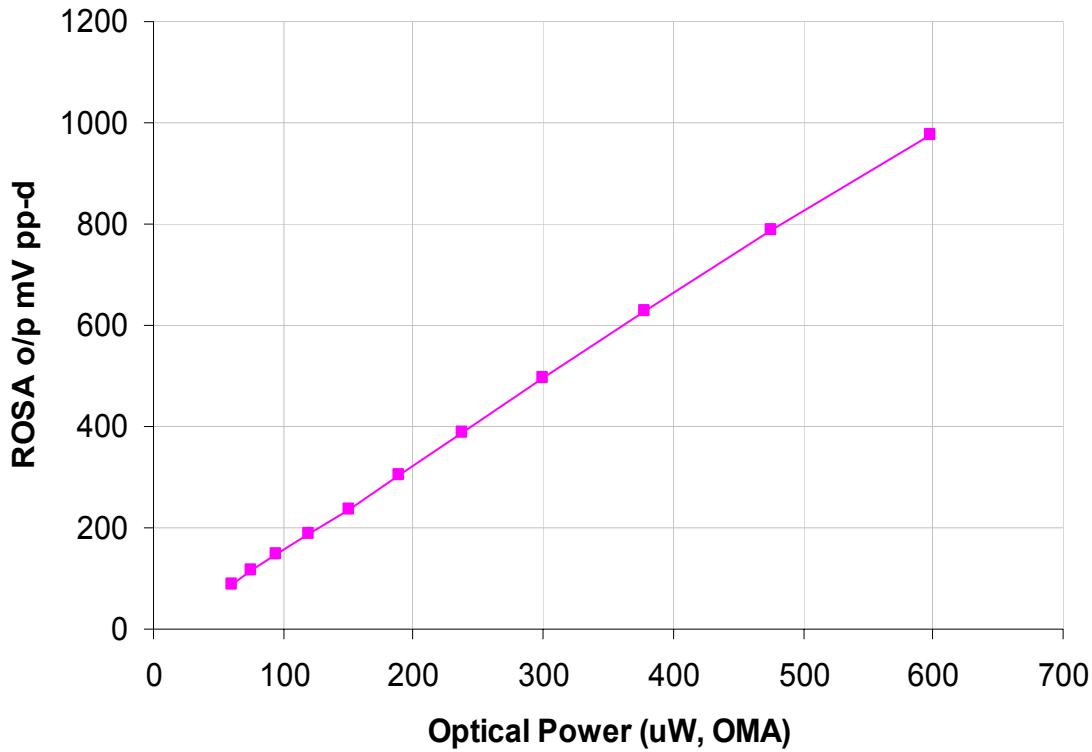
- Test for compliant performance at specified BER (1e-12) and SNR

Informative: ROSA Responsivity Compliance



- Relaxed specs to allow for low-cost ROSA design
- Minimum ROSA sensitivity over possible spatial offsets
- Min Sensitivity >= R >= Max sensitivity

Informative: ROSA Linearity Compliance



- Sufficient ROSA linearity over the input signal dynamic range

Conclusions

- A Simple Reproducible Compliance Method for Low Cost Volume Manufacturing
- Allows everyone to test against “agreed” representative worse case MMF fiber channel
- Normative tests for the Receiver and Transmitter
- Informative tests for components to support wide vendor base and seamless inter-op.